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ABSTRACT

An evaluation was conducted of the Boeing Company's summer internship program for students enrolled in a manufacturing technology program after grades 11, 12, and 13 (first year of community college). The evaluation included the following activities: a review of documents describing the internship structure, student selection process, and curricula; interviews with each of the 199 interns who had participated in the program and with a sample of alternates; interviews with business representatives; and written surveys of interns conducted both before and after their summer internships. The study found that the Boeing internship motivated students to stay in school and provided valuable work experience. It also found that the internship was very successful in teaching the manufacturing-related skills designated at each level of the program. The students rated the learning environment at the company superior to that of their high schools. In addition, companies other than Boeing were impressed with the program and willing to take students who had interned the previous 2 years at Boeing. Recommendations were made to continue the program, to connect the program with the high school curriculum, to provide an exploratory workplace experience, to improve the internship curriculum, to help student interns find relevant jobs, and to continue to use evaluation to improve the program. (KC)

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ED 391 915

THE Northwest Regional Educational Laboratory

EVALUATION REPORT

THE BOEING COMPANY'S MANUFACTURING TECHNOLOGY STUDENT INTERNSHIP

EVALUATION REPORT

(1994–95)

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The Boeing Company's Manufacturing Technology Student Internship

EVALUATION REPORT (1994–95)

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December 1995

EXECUTIVE SUMMARY

In February 1993, The Boeing Company approved a summer internship program for students enrolled in a manufacturing technology program. This program provides students with three progressive internship levels offered in the summers of the 11th, 12th, and 13th grades (through the first year of community college). The internship is meant to accomplish the following objectives:

1. Introduce students to career opportunities in manufacturing technology
2. Teach basic manufacturing skills
3. Develop workplace basics skills
4. Help students plan for their future
5. Assist in high school drop-out prevention

Since the summer of 1993, a total of 199 students have participated in the Boeing student internship program in the Seattle and Portland areas. This report summarizes major findings from the summer internship 1995 and presents recommendations based on these findings.

METHODOLOGY

NWREL's comprehensive evaluation of the student internship in manufacturing technology involved a number of methodologies. These included a careful review and study of documents describing the internship structure, student selection process, and curricula; interviews with each intern and with a sample of alternates; interviews with business representatives; and written surveys of interns conducted both before and after their summer internships.

The written surveys developed by NWREL consisted of pre- and post-surveys for each internship level: basic, intermediate, and advanced. Each set of pre- and post-surveys included questions on the following subjects:

- The amount of knowledge students had before and after the internship on the manufacturing competencies—for example, precision measuring—to be taught at different levels of the internship (basic, intermediate, or advanced)
- Broader employability outcomes such as group participation, and educational and occupational plans

- Interns' assessment of the learning environments in their home high schools the previous year and during their summer internship

- The strengths and weaknesses interns perceived in the internship and suggestions for improving it

MAJOR FINDINGS

1. Data from this year and the previous two years clearly indicate that the Boeing internship has motivated students to stay in school and continue their education in their areas of interest. It provides valuable work experiences for students not only in basic employability as well as in specific areas of manufacturing technology. Almost all interns we surveyed in the past three years indicated they would recommend the internship to their friends.

2. The internship is very successful in teaching the manufacturing-related skills designated at each level of the summer internship. Data for 1995 and the previous two years consistently show that students' knowledge of these skills increased significantly by the end of each summer internship. Learning these skills during the summer internship helped students relate skills and knowledge acquired in school to those used in the workplace. However, the student internship has limited impact on changing instruction in those schools from which student interns were selected.

3. In the past three years, student interns consistently rated the learning environment of the Boeing internship as superior to that of the high schools from which they came. For example 91 percent of the interns indicated their Boeing instructors helped them see the purposes for what they were learning, whereasas only 67 percent of the interns indicated so about their high school teachers.

4. Over the past three years, students consistently identified teamwork, hands-on experience, learning various manufacturing-related skills, and being treated as adults as major strengths of the internship. Students have generally become more self-confident after their summer internship.

5. Students were generally satisfied with the recruiting process and felt the orientation was helpful. Most students were able to handle the interview questions. However, students wanted to have more information before the interview.

6. Over the past three years, students expressed that they had benefited enormously from hands-on experiences through the internship. But they still felt the opportunities for hands-on experiences during the internship could be strengthened. They suggested that in-class lectures be shortened and be sequenced to reduce redundancies.

7. Interviews with student interns and non-Boeing company representatives show that other manufacturing companies are also willing and able to provide internship

opportunities for students. Third-year Boeing interns had a smooth transition from Boeing sites to non-Boeing sites this summer. Students felt that the previous two years' experience at Boeing was helpful for their third-year internship at these new sites. Non-Boeing company representatives were enthusiastic about hosting student interns in their companies and felt the investment in such programs was justified for the benefit of students as well as for their companies in the long run. They would like to work closely with Boeing to further define the goals and objectives of such internships so that they will be able to do a better job next year.

RECOMMENDATIONS

1. **Continue the internship**

Over the past three years the evaluation results have facilitated continuous quality improvement for the internship program. The results of the evaluation also clearly indicate that the internship has had a positive impact on many students in their educational aspirations and career plans. The Boeing staff is to be commended for introducing the internship program into other manufacturing companies; the placement of advanced Boeing student interns at non-Boeing sites has turned out to be successful. In conclusion, the Boeing internship is a valuable program and deserves further funding to continue at Boeing and to expand to other manufacturing companies.

2. **Connect with school-based programs**

While the student internship has operated effectively and benefited participating students, the internship experience generally stands isolated from the students' high school curriculum. Thus, from a systemic perspective, its full impact on the education of high school students is limited. As is true for most school-to-work efforts across the country, there is a crucial need for an effective link between school curriculum and work-based experiences. We recommend:

- Student selection criteria should be structured to admit to the program only those students who: 1) are interested in manufacturing technician work as shown in their individual career and education plans, 2) have taken one or two CORD applied academics courses or other academic courses that include application to the workplace, and 3) have taken at least 2 sequenced courses in manufacturing technology or a related field.

- The consecutive three-year internship should equip these interns with skills adequate for an entry manufacturing technician position. Efforts need to be made to help these students find a job in the field after they have completed a manufacturing-related degree.

- To connect the interns' school coursework with their summer internship experiences, participating schools might also be required to have a team of at least four academic and vocational teachers plus one school counselor and one school

administrator to observe a minumum of one day of the first year student internship and establish some ways they could address some of the internship competencies in their regualar school year courses.

3. **Provide an exploratory workplace experience**

For those 10th grade students who are not sure if they want to go into the manufacturing field, an exploratory workplace experience might be designed jointly by Boeing and participating high schools, such as a one-week summer camp, visitation to several manufacturing firms, plus other school-based experiences. Such a program could also provide these students with some overall understanding of the workplace and allow them to complete a project demonstrating the relevance of school work to the real world. These students could then be candidates to participate in the consecutive three-year internship if they demonstrated serious interest in a career in manufacturing. The Boeing Company could use experiences like these to screen internship candidates.

4. **Improve the internship curriculum**

Our data show that many of the student interns were interested in the relationship between manufacturing and engineering. Next year's curriculum might include this topic. The internship should continue to focus on hands-on activities that students do not have the opportunity to perform in school settings. The necessary classroom instruction provided during the internship should be as short as possible and be directly related to the hands-on projects that follow.

6. **Help student interns find relevant jobs**

Last year most Boeing interns had temporary jobs unrelated to manufacturing. We recommend coordinating with regional manufacturers that hire part-time workers for possible employment of students during the school year or as summer replacements. For example, in partnership with Spokane Community College, Kaiser Aluminum Co. in Spokane hired students to be summer replacement workers for its employees on vacation. The program has been very successful. Many of those student interns have ended up being employed by that company.

7. **Continue to use evaluation as a tool for program improvement**

Over the past three years the program evaluation has proved to be useful for continuous quality improvement. For next year's evaluation, we recommend: 1) a follow-up study of graduates from this summer, 2) a study of those students who dropped out of the internship this summer, 3) continued pre- and post-assessment of student interns at all three levels, and 4) a review of internal evaluation such as student performance test results.

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Lynn Wolters at Mt. Hood Community College arranged for the evaluator to observe the internship process in the Portland area and collected student survey data. Steve Funk-Tracy of the Northwest Regional Educational Laboratory (NWREL) supervised data entry and Angela Cook, also of NWREL, assisted in the data entry and data tabulation. We also wish to thank the student interns and instructors, without whom there would be no program.

INTRODUCTION

The Boeing Company recognizes the need for industry to be more actively involved in improving the education, skills, and employability of as much as 80 percent of our youth who will not receive a four-year college degree. As a result, Boeing has developed a workplace internship modeled after the nationally recognized Tech Prep initiative.

A Tech Prep program combines a high school and community college competency-based curriculum in applied academics and vocational-technical courses leading to an associate degree in technology. Students prepare for technical jobs in the workplace, as well as for continued education leading to advanced degrees. Successful students will have a clear concept of manufacturing technology and certain manufacturing-related skills the day they enter the workforce and be able to progress to higher levels of employment.

The Boeing Company's involvement in the Tech Prep program has been implemented in three phases. The initial phase helped build the applied academic foundation in Washington state's secondary school system. The second phase promoted the development of a statewide manufacturing technology degree program (within Tech Prep) and provided a work-based student internship program related to manufacturing technology. The third phase involves Boeing in a consortium with other manufacturing companies and educators in a statewide effort to develop manufacturing competencies and curriculum modules based on the needs of industry, and to involve other companies in Washington in expanding work-based learning opportunities for young people.

In February 1993, Boeing approved a summer internship program for students enrolled in a manufacturing technology program. This program provides students with three progressive internship levels offered in the summers of the 11th, 12th, and 13th grades (the first year of community college). The internship is meant to accomplish the following objectives:

1. Introduce students to career opportunities in manufacturing technology.
2. Teach basic manufacturing skills.
3. Develop workplace basics skills.
4. Help students plan for their future.
5. Assist in high school drop-out prevention.

The internships are coordinated with participating high schools and colleges to ensure that instruction complements students' academic courses. Each summer internship lasts four weeks for first- and second-year student interns, and six weeks for third-year student interns. All interns are paid. In the first year the internship focuses on the basics of manufacturing technology and provides students an overview of career opportunities in this area. (The first summer is hereafter referred to as the basic internship.) The second year

internship (hereafter referred to as the intermediate internship) allows students to explore specific areas in manufacturing technology. The third year internship (hereafter referred to as the advanced internship) provides students with opportunities for job shadowing certain specialty areas in which they are interested, and prepares them for an associate degree in manufacturing technology. The figure below shows the path of a manufacturing technology degree program.

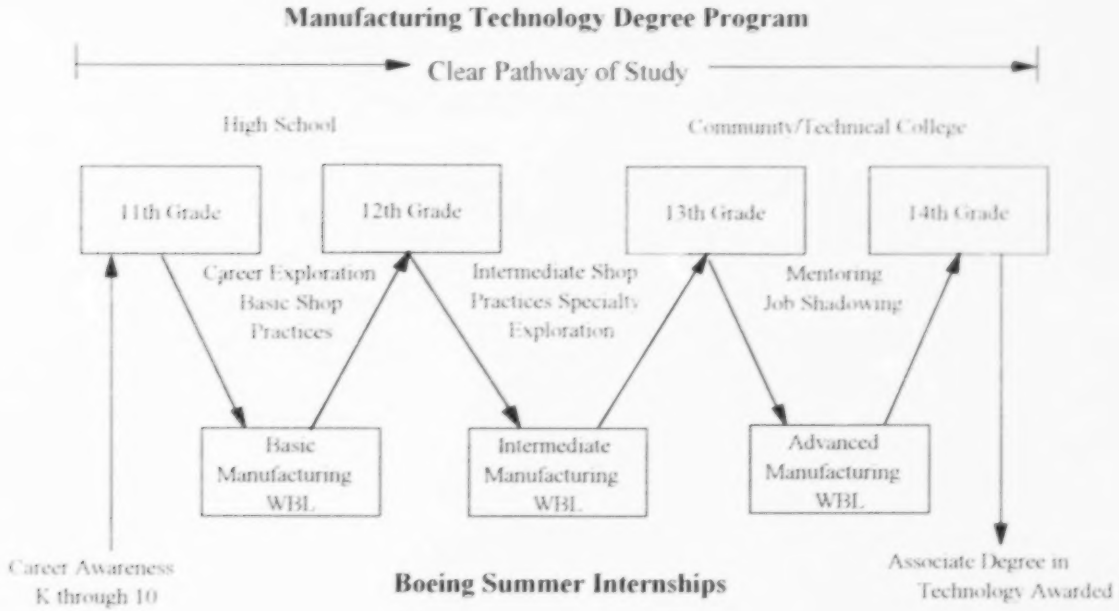

Figure 1: Boeing Manufacturing Technology Program

Since the summer of 1993, a total of 199 students have participated in the Boeing student internship program in the Seattle and Portland areas. In the summer of 1993, 25 students started the basic internship. In the summer of 1994, the same 25 students moved from the basic internship to the intermediate one. An additional 75 students in the Seattle area and 12 in the Portland area started the basic internship. In the summer of 1995, 20 out of the 25 students who completed the basic and intermediate internships participated in the advanced internship. Sixty-four students in the Seattle area and nine in the Portland area moved from the basic internship to the intermediate one. An additional 75 students in the Seattle area and 12 in the Portland area started the basic internship. The following table summarizes the number of Boeing student interns in the summers of 1993, 1994, and 1995 at different internship levels.

Table 1
Number of Boeing Interns in the Summers of 1993, 1994, and 1995

	1993	1994	1995
Seattle	(Basic) 25	(Intermediate) 25 →	(Advanced) 20
		(Basic) 75 →	(Intermediate) 64
			(Basic) 75
Portland		(Basic) 12 →	(Intermediate) 9
			(Basic) 12
TOTAL	25	112	191

The focus of this report is the work-based student internship program of summer 1995. Three groups of students from the Seattle and Portland areas participated in the program that summer. One group started their basic internship in summer 1995. A second group started their basic internship in summer 1994 and moved into their intermediate internship in summer 1995. A third group in the Seattle area started their basic internship in summer 1993, moved into the intermediate internship in summer 1994, and into the advanced internship in summer 1995.

Data for this report were collected in summer 1995 from pre- and post-surveys of students as well as interviews with the advanced interns and representatives from different non-Boeing companies that for the first time served as internship sites for some advanced Boeing student interns.

OVERVIEW OF EVALUATION PROCESS

Purpose

The Boeing Company contracted with the Northwest Regional Educational Laboratory (NWREL) to evaluate the student internship program. The purpose of this evaluation is to (1) describe comprehensively the operations and outcomes of the student internship, (2) provide information for continuous quality improvement of the internship, (3) document the impact of the internship on students and others, and (4) identify promising practices related to the internship that could be adapted by others in business and industry interested in developing similar student internships.

Methodology

NWREL's comprehensive evaluation of the student internship in manufacturing technology involved a number of methodologies. These included a careful review and study of documents describing the internship structure, student selection process, and curricula; interviews with each intern and with a sample of alternates; written surveys of interns conducted both before and after their summer internships; and a follow-up study to determine the work and educational paths taken by high school intern graduates and their experiences since high school graduation.

The written surveys developed by NWREL consisted of pre- and post-surveys for each internship level: basic, intermediate, and advanced. Each set of pre- and post-surveys included questions on the following subjects:

- The amount of knowledge students had before and after the internship on the manufacturing competencies—for example, precision measuring—to be taught at different levels of the internship (basic, intermediate, or advanced)
- Broader employability outcomes such as group participation, and educational and occupational plans
- Interns' assessments of the learning environments in their home high schools the previous year and during their internship
- The strengths and weaknesses interns perceived in the internship and suggestions for improving it

FINDINGS

The findings in this report are organized around the levels of internship. Findings related to this year's internship are compared with the previous two-year findings whenever a trend is apparent.

Basic Internship

In summer 1995, a total of 87 students participated in the basic internship, 75 in the Seattle area and 12 in the Portland area. All students had just completed 11th grade. About 81 percent of the basic internship students were male and about 77 percent were white. These 87 students were selected from 21 schools or school districts, 15 in Seattle and six in Portland. As in previous years, the data collected this year show that teachers and counselors continue to play an important role in recruiting student interns and that parents are very supportive of their children participating in the summer internship.

Seventy-three students in the Seattle area and 12 students in the Portland area responded to both the pre- and post-surveys designed for the basic internship. Complete survey results are in Appendices A and B. The following sections summarize student findings regarding various aspects of the internship program.

Preparing for the Internship

A quarter of the students from both the Seattle and Portland areas indicated that the interview they had for getting into this internship was their first job interview. The majority of the students (more than 80 percent) did not have problems with the interview questions. For those who did, the most frequently mentioned problems included the following:

- Some questions were too general, such as "If you had a factory, what rules would you give your employees?"
- Some questions were repeated.
- Some students felt nervous in the interview and unable to find the right language to answer the interview questions.

Close to 90 percent of the survey respondents felt that the orientation was helpful and 10 percent were not sure. Most students indicated that through this orientation they were able to understand what was expected of them during the internship and how the internship related to their future college education.

When asked what they would recommend to improve the selection process, some students suggested the following:

- Notifying internship candidates about the date of the interview in enough advance time

- Providing more information regarding the program
- Asking more specific questions
- Having more students and more school districts involved in the recruiting process

Work and Educational Plans

About half the respondents had weekend or after-school jobs; most of these jobs were non-technical or manual. When asked if they had any work plans after high school graduation, 56 percent of Seattle respondents and 82 percent of Portland respondents indicated "yes" in the pre-survey; in the post-survey, 70 percent of Seattle respondents and 92 percent of Portland respondents indicated "yes." Although the number of students who had work plans after high school graduation increased after the summer internship, there were no significant changes in the type of work they desired to do. About 20 percent of jobs listed by Seattle interns and 36 percent of Portland interns in the post-survey were related to manufacturing technology.

Ninety-two percent of the respondents in the Seattle area indicated in the pre-survey that they had educational plans for after high school graduation. The overwhelming majority of them plan to continue their postsecondary education in two-year community colleges or technical/vocational schools in the Northwest. In the Portland area, students had to agree to attend Mt. Hood Community College after their high school graduation to be qualified to participate in the Boeing-sponsored summer internship.

Students' Self-ratings of Their Ability to Learn Mathematics and Science, and to Write Well

In pre- and post-surveys student interns were asked to rate their ability to learn mathematics and science and to write well on a scale of "excellent," "good," "fair," and "poor." The overall self-ratings of the three areas on the post-survey were higher than ratings on the pre-survey. Compared with the pre-survey, on the post-survey more interns rated themselves "excellent" or "good" in the ability to learn mathematics and science, and to write well. Table 2 summarizes basic student interns' self-ratings in these areas. In the Seattle areas, students rated themselves significantly higher on their ability to write well on the post-survey compared with their self-rating on the pre-survey. In the Portland area, students rated themselves significantly higher on their ability to learn math on the post-survey compared with their self-rating on the pre-survey. No significant differences were found for other ratings between the pre-survey and post-survey.

Table 2
Basic Student Interns' Self-ratings of Ability to Learn Mathematics and Science, and to Write Well
(in percent)

	Seattle Area	
	Good or Excellent	
	Pre	Post
Math	73	78
Science	89	89
Writing	72	81*
	Portland Area	
	Good or Excellent	
	Pre	Post
Math	60	92*
Science	100	91
Writing	90	91

* Indicates the post-survey rating is significantly higher than the pre-survey one at the .05 level

Basic Students Self-ratings of Knowledge of Internship Topics

Specific topics were selected by The Boeing Company for each level of student internship. Interns were assessed before and after the internship concerning to what degree they knew these topics: "a lot," "some," "little," or "none." Tables 3 and 4 show the percentage of Seattle and Portland interns who indicated "a lot" or "some" on the pre- and post-surveys. Seattle interns rated themselves significantly higher on the post-survey on 21 of the 28 areas rated. On the post-survey 90 percent or more of the Seattle interns said that they knew "a lot" or "some" on 15 of the 28 areas rated. Only two areas (computer-aided design and budgeting money) has less than 75 of the interns indicating "a lot" or "some."

In Portland, on the post-survey 90 percent or more of the interns indicated "a lot" or "some" on 23 of the 28 areas rated (100 percent of the interns indicated "a lot" or "some" on 15 areas). In only one area (statistical process control) did less than 75 percent of the interns responded with ratings of "a lot" or "some." Compared with their pre-survey rating, Portland students rated themselves significantly higher on the post-survey on 12 of the 28 areas rated.

Table 3
Percentage of Seattle Basic Interns Reporting They Knew "a Lot" or "Some" Regarding Various Topics on the Pre- and Post-survey (N = 73)

Topics	Pre	Post
Just in time production systems	15	94*
Statistical process control	20	88*
Tool design	34	97*
Blueprint reading	36	99*
Hazardous waste management/Hazardous materials	29	90*
Continuous quality improvement	48	100*
Manufacturing process	48	99*
Manufacturing materials	45	94*
Assembly lines	43	89*
Manufacturing math/trigonometry	43	86*
World class competitiveness	41	82*
Precision measuring	59	96*
Shop practices	68	94*
Computer-aided design	41	65*
Diversity in the workplace	80	96*
Shop safety	84	89
Team Building/Working in teams	95	97*
Importance of punctuality	85	86
Problem solving	92	92
Group participation	94	94
A sense of being part of a group	96	94
Budgeting time	91	85
Getting along with others	97	91
Getting up on time for work	99	88*
Appropriate behavior/Workplace ethics	99	88*
Budgeting money	85	73*
Regular attendance at work	99	86*
Preparing myself for work each day	94	79*

* Indicates the post-survey rating is significantly higher than the pre-survey one at the .05 level.

Table 4
Percentage of Portland Basic Interns Reporting They Knew "a Lot" or "Some" Regarding Various Topics on the Pre- and Post-survey (N = 12)

Topics	Pre	Post
Just in time production systems	18	100*
Hazardous waste management/Hazardous materials	20	92*
Tool design	34	100*
Quality cost delivery system	41	100*
Statistical process control	27	73*
Manufacturing math/trigonometry	58	100*
Assembly lines	64	100*
Computer-aided design	58	92*
Manufacturing materials	59	92*
Budgeting time	73	100
Shop practices	66	92
Manufacturing process	75	100*
Continuos quality improvement	75	100*
Precision Measuring	75	100*
Blueprint reading	59	83
Problem solving	92	100
Team Building/Working in teams	92	100
Group participation	92	100
A sense of being a part of a group	92	100
Budgeting money	81	83
Importance of punctuality	100	100
Shop safety	92	92
Appropriate behavior/Workplace ethics	92	92
Getting along with others	92	92
Preparing myself for work each day	100	100
Diversity in the workplace	84	83
Regular attendance at work	100	92
Getting up on time for work	100	83

* Indicates the post-survey rating is significantly higher than the pre-survey one at the .05 level.

Learning Environment

One section of the survey asked students to rate on a 5-point scale ("strongly agree," "agree," "uncertain," "disagree," and "strongly disagree") the extent to which they agreed or disagreed with a number of positive statements about the learning environment in their high school or community college classes and in their summer internship. This was

to determine the comparative quality of the learning environment for the Boeing internship. Other research studies have shown that these learning environment characteristics are critical for effective understanding and retention of knowledge. Tables 5 and 6 show the comparisons. In general, both Portland and Seattle interns gave higher marks to their internship learning environment than to their high school learning environment. Portland interns gave higher marks to their high school learning environment than did Seattle interns.

In compiling the ratings they gave to their high schools, Seattle interns gave significantly higher marks to the Boeing internship on every item relating to the learning environment. In contrast, Portland interns gave significantly high marks to their Boeing internship on 5 of the 10 items rated.

Table 5
Percentage of Seattle Basic Interns Who Agreed or Strongly Agreed with Positive Statements Regarding the Learning Environment of Their Last Year's High School Classes and the 1995 Internship
(N = 73)

Statement	1994-95 High School	1995 Internship
Teachers/The Boeing instructors helped me see the purposes for what I am learning	67	91*
New information is connected to what I already know	80	93*
The information to be learned is related to practical, real-life applications	51	93*
The information in one class is related to what is being taught in other classes/the internship	48	89*
Students are encouraged to use the knowledge gained to solve problems	63	92*
Students work together as a team	76	93*
Students have opportunities for hands-on learning	63	98*
Courses are/Information was taught in an interesting manner	54	72*
Teachers show/the Boeing staff showed that they really care about me	57	88*
Teachers/Instructors sometimes work together to plan or present the class (team teaching)	45	85*

* Indicates the post-survey rating is significantly higher than the pre-survey one at the .05 level.

Table 6
Percentage of Portland Basic Interns Who Agreed or Strongly Agreed with Positive Statements Regarding the Learning Environment of Their Last Year's High School Classes and the 1995 Internship
(N = 12)

Statement	1994-95 High School	1995 Internship
Teachers/The Boeing instructors helped me see the purposes for what I am learning	85	92
New information is connected to what I already know	92	100
The information to be learned is related to practical, real-life applications	76	100*
The information in one class is related to what is being taught in other classes/the internship	75	100*
Students are encouraged to use the knowledge gained to solve problems	75	92*
Students work together as a team	100	100
Students have opportunities for hands-on learning	92	100
Courses are/Information was taught in an interesting manner	66	84
Teachers show/the Boeing staff showed that they really care about me	67	100*
Teachers/Instructors sometimes work together to plan or present the class (team teaching)	58	83*

* Indicates the post-survey rating is significantly higher than the pre-survey one at the .05 level.

In addition to the above list of learning environment characteristics, the majority of Seattle interns (77 to 96 percent) and Portland interns (82 to 100 percent) agreed or strongly agreed with some other statements directly relating to their summer internship experience. This information is shown in Table 7.

Table 7
Percentage of Seattle and Portland Basic Interns Who Agreed or Strongly Agreed with Positive Statements about the Internship

Statement	Seattle	Portland
I feel that manufacturing would be an interesting career field	77	83
The instructors knew their subject content well	87	100
The instructors treated me as a responsible adult	80	100
Compared with my high school classes, I feel I was more successful as a learner at Boeing	85	83
Learning can be fun	90	100
I would recommend this internship to my friends	96	100
I generally discussed my internship experience with my parents/family at least weekly	84	100
This internship will help me with my future education	96	100
This internship will help me with my future employment	96	100
The Boeing staff sometimes made program changes on input from student interns	84	82

Basis for Selecting High School Courses

At the beginning of the summer internship students were asked on what basis they usually selected high school courses; at the end of the internship students were asked on what basis they were going to select high school courses on their return to school. As seen in Table 8, the pre- and post-surveys reveal that high school graduation requirements and students' educational and work plans were major reasons for high school course selection. Compared with responses at the beginning of the internship, fewer students at the end of the internship indicated they would select a high school course based on how easy it is. For the other reasons, no clear patterns were found among basic interns. For example, fewer Seattle students at the end of the internship indicated that they would select a high school course on the basis of their work plans, but Portland interns indicated just the opposite.

Table 8
Basis for Selecting High School Courses

	Seattle		Portland	
	Pre	Post	Pre	Post
It depends on the classes my friends are taking	20	11	8	8
How easy the class is said to be	11	6	8	0
How it fits into my future educational plans	88	70	92	92
How it fits into my future work plans	78	75	83	100
High school graduation requirements	86	75	75	58
College entrance requirements	60	44	67	50
Advice from a counselor	41	40	42	50
Advice from a teacher	40	22	25	42
Advice from parents/family	33	19	25	42
Other	18	11	17	17

Strengths and Weaknesses of the Summer Internship and Recommendations

Three open-ended questions in the post-survey asked interns to identify major strengths and weaknesses of the summer internship and to give recommendations for improving the Boeing internship for next year.

Seattle area. The Seattle respondents identified the following as strengths of the summer internship:

- Working in teams and leaning how to get along well with others
- Learning the importance of punctuality and regular attendance
- Hands-on experience of various manufacturing skills
- Understanding what manufacturing technology is about
- Being motivated to improve reading and writing skills

Major weaknesses noted included the following:

- Inadequate tools and reading materials for student interns and lack of contingency plans when, for example, an instructor was sick.
- Poorly sequenced instruction so that there were many repetitions.
- Too many lectures and too much idle sitting around. Some speakers were boring.
- Having to get up early every day for work.

Changes suggested for 1996 included the following:

- Instruction needs to be better sequenced so there will not be too many repetitions.

- Lectures need to be challenging, short, and right on the topic. Better speakers are desired.
- More hands-on experiences and fewer hours of in-class lectures.

Students were also asked what kind of things they planned to do during their next year of school to keep them focused on future career possibilities in manufacturing technology. The following is a list of actions most students plan to take:

- Enroll in manufacturing classes or classes related to manufacturing technology, such as math, drafting, shop, computers, and applied courses.
- Look for opportunities of working part-time in manufacturing companies to obtain more hands-on experiences.
- Obtain more information from counselors and teachers regarding manufacturing technology programs in community colleges.
- Keep in touch with Boeing employees and read news from Boeing.

Portland area. The major strengths of the summer internship identified by Portland interns include the following:

- Boeing employees and instructors were great, they were very helpful and motivated students to learn more.
- Interns learned many new skills relating to manufacturing technology through hands-on experiences.
- Interns learned how to work in teams and get along well with others.

The weaknesses of the summer internship included the following:

- Discipline problems with some students. For example, they talked while listening to headphones, slept over discussion, showed up late, and did not participate in group activities.
- In the first week of the internship, there was too much sitting in the classroom.

Changes suggested by Portland interns for 1996 include the following:

- Alternate hands-on experiences and in-class lectures regularly throughout the summer internship. Put more emphasis on hands-on experience and allow more opportunities for students to learn by doing.
- Students need to have more time to absorb what they have learned.
- Students need to have better self-discipline.

As for the things they would like to do during their next year of school to keep them focused on future career possibilities in manufacturing technology, Portland interns mentioned the following:

- Sharing the internship experience with other students
- Taking classes relating to manufacturing technology
- Using the workplace standards to measure their school behaviors. For example, show up on time for all classes and be aware of the quality of anything they want to do.

Intermediate Internship

In the summer of 1995, a total of 73 students took the Boeing intermediate internship, 64 in the Seattle area and nine in the Portland area. This group of students had just graduated from their high schools before the summer internship. They completed their basic internship in the summer of 1994. This section presents the results of pre- and post-surveys administered to this group of students before and at the end of the summer internship. Fifty-eight Seattle interns and nine Portland interns completed both pre- and post-surveys. Complete survey results are in Appendices C and D.

Work and Educational Plans

Eighty-six percent of Seattle respondents indicated on the pre-survey that they had educational plans after high school graduation. Most of them will continue their postsecondary education in two-year community colleges or technical/vocational schools. All Portland interns planned to go to Mt. Hood Community College.

When asked if they had any work plans after graduation, 79 percent of Seattle interns and all Portland interns indicated "yes" on the pre-survey, and 81 percent of Seattle interns and all Portland interns indicated "yes" on the post-survey. There were no significant changes in the type of work they planned to do before and after the summer internship. Although a few indicated they would like to continue their Boeing internship next year or look for manufacturing-related jobs, most were going to keep their current jobs to earn money for their postsecondary education. Most of their current jobs were not directly related to manufacturing technology.

Students' Self-ratings of Their Ability to Learn Mathematics and Science and to Write Well

Intermediate interns were also asked to rate their ability to learn mathematics, science, and to write well on pre- and post-surveys on a scale of "excellent," "good," "fair," and "poor." No significant changes were found in Seattle interns' pre- and post-ratings of these three areas. However, the difference between the pre- and post ratings of Portland interns was dramatic. All Portland interns rated their ability in these three areas either as "excellent" or "good" on the post-survey. See Table 9 for a summary.

Table 9
Intermediate Student Interns' Self-ratings of Ability to Learn Mathematics and Science, and to Write Well (in percent)

	Seattle Area	
	Good or Excellent	
	Pre	Post
Math	71	64
Science	73	69
Writing	74	69
	Portland Area	
	Good or Excellent	
	Pre	Post
Math	44	100*
Science	78	100*
Writing	67	100*

* Indicates the post-survey rating is significantly higher than the pre-survey one at the .05 level.

Intermediate Interns' Self-ratings of Knowledge of Various Topics Relating to Manufacturing Technology

Manufacturing technology topics addressed in the Seattle area and those addressed in the Portland area differed slightly for the intermediate internship. But both Seattle interns and Portland interns reported increased knowledge of these topics on the post-survey compared with their self-ratings on the pre-survey.

In the Seattle area, student interns rated significantly higher all items on the post-survey compared with their ratings on the pre-survey. An average of 41 percent (ranging from 14 percent to 67 percent) more of the interns indicted on the post-survey that they knew "a lot" or "some" on the 11 areas rated.

In the Portland area, students rated themselves significantly higher on 7 of the 10 items rated. An average of 36 percent (ranging from 11 percent to 66 percent) more of the interns indicated on the post-survey that they knew "a lot" or "some" on the 10 areas rated.

Tables 10 and 11 summarize the percentage of Seattle and Portland interns who reported that they knew "a lot" or "some" about various topics relating to manufacturing techno l-ogy on pre- and post-surveys.

Table 10
Percentage of Seattle Intermediate Interns Reporting They Knew "a Lot" or "Some" about Various Topics or Skills on the Pre- and Post-survey (N = 53)

Topics	Pre	Post
Optics in manufacturing	16	83*
Project alignment	58	93*
Resource management and manufacturing	34	93*
Manufacturing unit cost	22	79*
Customer buy-off	38	86*
Numerical control	34	76*
Blueprint interpretation	54	95*
Labor and industry relations	53	88*
Project evaluation	58	86*
Group dynamics and communication	76	95*
Customer relations	83	97*

* Indicates the post-survey rating is significantly higher than the pre-survey one at the .05 level

Table 11
Percentage of Portland Intermediate Interns Reporting They Knew "a Lot" or "Some" Regarding Various Topics Skills on the Pre- and Post-survey (N = 9)

Topics	Pre	Post
Manufacturing unit cost	22	88*
Resource management and manufacturing	44	89*
Numerical control	33	78
Project alignment	56	100*
Project evaluation	56	97*
Labor and industry relations	44	78*
Numerical control programming	44	78*
Group dynamics and communication	78	100*
Customer relations	56	78
Customer satisfaction	78	89

* Indicated that the post-survey rating is significantly higher than the pre-survey one at the .05 level.

Learning Environment

Regarding the learning environment in high school classes and in the summer internship, the survey results show that both Seattle and Portland interns gave their summer internship higher marks on each statement in Tables 12 and 13. Seattle interns rated the learning environment at the Boeing internship significantly higher on all items rated compared with their ratings on their high schools. Portland interns rated the learning environment at the Boeing internship significantly higher on 6 of the 10 items rated. Tables 12 and 13 summarizes the percentage of Seattle and Portland interns who agreed and strongly agreed with each of the positive statements regarding their last year's school classes and their 1995 summer internship.

Table 12
Percentage of Seattle Interns Reporting They Agreed or Strongly Agreed with the Statements Regarding Last Year's High School Classes and the 1995 Intermediate Internship
(N = 58)

Statement	1993-94 High School	1994 Internship
Teachers/the Boeing instructors helped me see the purposes for what I am learning	61	95*
New information is connected to what I already know	69	83*
The information to be learned is related to practical, real-life applications	52	85*
The information in one class is related to what is being taught in other classes/the internship	37	81*
Students are encouraged to use the knowledge gained to solve problems	74	97*
Students work together as a team	49	96*
Students have opportunities for hands-on learning	55	97*
Courses are/Information was taught in an interesting manner	35	75*
Teachers show/The Boeing staff showed that they really care about me	52	81*
Teachers/Instructors sometimes work together to plan or present the class (team teaching)	43	87*

* Indicates that the post-dating is significantly higher than the pre-survey rating at the .05 level

Table 13
Percentage of Portland Interns Reporting They Agreed or Strongly Agreed with the Statements Regarding Last Year's High School Classes and the 1995 Intermediate Internship
(N = 9)

Statement	1993-94 High School	1994 Internship
Teachers/the Boeing instructors helped me see the purposes for what I am learning	89	100
New information is connected to what I already know	66	100
The information to be learned is related to practical, real-life applications	67	89*
The information in one class is related to what is being taught in other classes/the internship	67	89*
Students are encouraged to use the knowledge gained to solve problems	100	100
Students work together as a team	55	88*
Students have opportunities for hands-on learning	66	100*
Courses are/Information was taught in an interesting manner	55	89
Teachers show/The Boeing staff showed that they really care about me	78	89
Teachers/Instructors sometimes work together to plan or present the class (team teaching)	67	89*

* Indicates that the post-survey rating is significantly higher than the pre-survey rating at the .05 level.

In addition to questions about the learning environment, specific questions were asked about the Boeing internship. Responses to these questions were given on a 5-point scale ranging from " strongly agree" to " strongly disagree." These responses are shown in Table 14. Of special note is that 91 to 100 percent of the interns felt the internship will help them with their future education and employment; 93 to 100 percent said they would recommend the internship to their friends.

Table 14
Percentage of Seattle and Portland Intermediate Interns Who Agreed or Strongly Agreed with Positive Statements about Their Internship Experiences

Statement	Seattle	Portland
I feel that manufacturing would be an interesting career field	74	89
The instructors knew their subject content well	95	100
The instructors treated me as a responsible adult	92	89
Compared with my high school classes I feel I was more successful as a learner at Boeing	88	88
Learning can be fun	91	100
I would recommend this internship to my friends	93	100
I generally discussed my internship experience with my parents/family at least weekly	86	89
This internship will help me with my future education	93	100
This internship will help me with my future employment	91	100
The Boeing staff sometimes made program changes on input from student interns	90	100

Strengths and Weaknesses of the Summer Internship and Recommendations

Open-ended questions were included in the survey to ask student interns to identify major strengths and weaknesses of their summer internship and make recommendations for improving the Boeing internship for the following year.

Seattle area. The major strengths identified by the Seattle respondents included the following:

- Learning how to work in teams and learn how to adapt in various situations
- Learning various skills related to manufacturing technology and relevant to future education and employment
- Better instructors and interesting projects this year

The major weaknesses identified by the Seattle respondents included the following:

- Too much sitting in the classroom
- Some boring projects
- Some employees in the building not knowing why students were there
- Inconsistent grading system

As for improvement, students recommended the following:

- Revise the grading system
- Reduce class time and have more time for hands-on experiences
- Allow more time for certain projects when necessary

In addition to recommendations, students were asked what kind of things might be done during their next year of school to keep them focused on future career possibilities in manufacturing technology. Here is a list of major things students planned to do:

- Work toward a degree in manufacturing in community colleges or four-year universities
- Take more classes relating to manufacturing
- Keep in touch with Boeing
- Look for opportunities of working in the area of manufacturing technology

Portland area. The major strengths identified by Portland interns included:

- Teamwork skills
- Various skills relating to manufacturing
- The fun of working at Boeing and the relevance of skills learned to future education and employment

The major weaknesses identified were the following:

- Too much seat time
- Inadequate help for group work

Students recommended the following:

- More challenging projects that are related to airplanes
- Allowing students to make more decisions

To keep on focusing on manufacturing after the summer internship, some students planned to:

- Take more classes related to the field
- Work toward a degree in manufacturing or get a related job
- Keep in touch with Boeing and look for more related working experience

Advanced Internship

A total of 20 students in the Seattle area took the advanced internship in the summer of 1995. This group of students took their basic internship in the summer of 1993 and their intermediate internship in the summer of 1994. They are the first group of students who graduated from the consecutive three-year summer internship.

Instead of doing the internship at various Boeing sites, some students interns in the third year completed their Boeing internship program at seven sites outside The Boeing Company. These non-Boeing manufacturing companies signed agreements with Boeing that they would host these third-year interns paid by The Boeing Company in the summer of 1995. By the summer of 1996, they will pay 50 percent of the interns' salary and by the summer of 1997, they will host interns of their own with full financial responsibility. It is Boeing's plan that their student internship program will be expanded to other manufacturing companies so more students can be involved.

To assess the effectiveness of the first-year expansion of the Boeing internship to other manufacturing companies, pre- and post-surveys were designed and interviews with these students and with non-Boeing company representatives were conducted.

Pre- and Post-surveys

Although a post-survey was designed for students to complete at the end of the internship, it was not administered because of a communication failure with site coordinators. Seventeen of the 20 advanced interns took the pre-survey. Complete results from this survey are in Appendix E.

Eighty-two percent of the 17 interns were attending a postsecondary institution (most of them were enrolled in community colleges) when they entered their third year. Fifty-nine percent were employed at that time and 42 percent of those employed worked full time. Fourteen percent of those employed indicated that they had some difficulty arranging with employers to be away from their current jobs for six weeks in order to participate in the internship. According to the job titles students listed on the survey, none of them were working on jobs directly related to manufacturing technology. Students' plans for future employment did not show their relevance to manufacturing, either.

Responding to the question of what they expected to gain from the third-year summer internship experience, students listed the following:

- Learning computer and engineering skills and other skills in general
- Learning relationship between manufacturing and engineering
- Obtaining more actual work experience

At the beginning of the internship, students were asked to what extent they knew about the topics to be covered during the summer internship. The following table summarizes the

percent of the respondents reporting they knew "a lot," "some," "little," or "none" about these topics upon entry to the advanced internship.

Table 15
How Much Respondents
Knew about Each Topic Related to Manufacturing Technology
on Entry to the Advanced Internship
(percent)

Topic	A Lot	Some	Little	None
Group dynamics and communication	24	65	12	0
Measurement	35	41	24	0
Safety and health	47	47	6	0
Quality assurance	18	65	12	6
Print interpretation	24	47	24	6
Shop skills	35	47	18	0
Business economics	12	53	35	0
Resource management and manufacturing computing	12	41	29	18
Product and process control	24	47	18	12
Labor and industry	18	53	18	12

Interviews with Student Interns

A total of 16 advanced interns were interviewed by Boeing and NWREL staff at the end of their summer internship. Complete interview responses are in Appendix F. Following are summaries of the responses to each interview question:

1. *What specific knowledge or skills did you learn this summer at the company? How will you be able to apply this?*

Students interns responded with a long list of skills learned during the summer internship. Some are specific and some are general. Mentioned by most students are the following:

- The 10 core competencies and some other specific skills and how they tie into manufacturing
- Teamwork and communication skills
- The relationship of work to education
- The experience of working every day

2. *Was your third-year internship different from the first two years'? If yes, in what ways?*

All students interviewed indicated that their third-year internship was different from the first two. The major differences they described included the following:

- The first two years at Boeing prepared them with the basic knowledge of a company's structure, so that during the third-year internship they were better able to understand what was going on at the worksite
- They had more opportunities to work on real jobs and talk to different people at the site
- They were able to see more connection between what was taught in the class and how it worked in the field
- They felt they were more trusted and had more responsibilities

3. *Was the first-two years' internship experience at Boeing helpful for your third-year internship? If yes, in what way? Is there anything you found common in the work-place between The Boeing Company and the company where you are interning this summer (if other than Boeing)?*

All interviewees indicated that the first two years' experience at Boeing was very helpful in preparing them for their third-year internship outside Boeing. They were able to apply some specific skills they learned at Boeing to the work they did in their third year. Boeing experience has prepared them to know what to look for in a manufacturing firm.

Students found the 10 core competencies, teamwork, just-in-time, and continuous quality improvement are common at various sites where they did their third-year internship this summer.

4. *Have you learned anything this summer that challenged your prior assumptions about manufacturing, about yourself, or relationship with others? What impact, if any, did this summer internship have on you in terms of your career goals, educational goals, thoughts about life-long learning, and future courses you would like to take? Have you obtained any new ways of obtaining information?*

In response to the above questions, students cited many new things they learned this summer that challenged their previous assumptions. One student admitted that his assumption regarding the administrative side of manufacturing differed greatly from what he observed during the summer. Another student was shocked by the layoff in the workplace. Many students were surprised that computers are used everywhere in manufacturing. Some students came to the conclusion after the summer internship that manufacturing is always changing and that to stay in this business one must keep on learning.

Overall, the third-year internship reinforced the students' previous two years' experience at Boeing as well as their educational and career goals. One student said, "This summer I

found a career that interests me. Before this summer I just could not answer those questions of what I wanted to do, but I can now." Many interviewees had similar experiences this summer.

5. *Could you give one or two examples of applying what you learned in school (high school or community college) to tasks at your internship. Did any of the applied academics courses you took help you during your summer internship?*

Trigonometry, drafting, keyboarding, computer skills, electronics, machine tools skills, and blueprint reading that students learned in high school or community college were found helpful and applicable to various internship tasks. Opinions were mixed regarding the usefulness of applied academics courses. One student said he learned drafting in an applied academics courses and found it helpful in his internship. Another student complained that all he did in an applied academics course was watch. A third student stated that none of the applied classes he took related to the tasks during the internship.

6. *What were the best parts of the internship for you? Why?*

Students were impressed by the quality of the employees at different sites. Students were thankful that these employees showed a great care for them and were anxious to know them. Students felt they had learned many good qualities from these employees, such as self-directedness, love for their work, and the care for their companies. Students also noticed that employees did not feel students were a threat to their jobs.

Students listed many specific skills they learned during the internship and appreciated the opportunity of getting to know a manufacturing firm. The internship has helped many students to become more self-confident and feel good about themselves. One student told the interviewer that he felt good about finding his car parked next to those of the president and CEO of the company at his internship every day.

7. *What parts of the internship should be improved for next year's group?*

Following are the major changes students would like to see for next year's group:

- Boeing needs to work closely with various host companies to make a curriculum plan for student interns, and students need to be involved in the process.
- Employees or supervisors who have direct contact with student interns should be informed of the purpose of the internship so they can be prepared.
- Procedures for maintaining a log should be simplified.
- Students need to have opportunities to share ideas during the internship.

Interviews with Non-Boeing Company Representatives

Nineteen non-Boeing company representatives were interviewed by a Boeing consultant at the end of the summer internship. They represented seven companies. Complete interview responses are in Appendix G. Following are summaries of the response to each interview question.

1. *How well prepared were you to take the Boeing student interns at your workplace?*

Most representatives indicated in the interview that they were quite well prepared for the students in spite of the fact that they were only notified of Boeing's decision to place interns with them shortly before the internship began. All the representatives understood the basic rationale of the internship and its general structure at Boeing. Some representatives said it was difficult for them to meet interns' individual needs and expectations with only a very short time for preparation,. Almost all representatives agreed they should prepare a formal outline for the internship for next year and be better prepared.

2. *What the are the benefits of this kind of internship program? Benefits to interns and to your company as a whole?*

Representatives were very articulate about the benefits to interns but ambiguous or general about the benefits to their companies. Some representatives stated they could not see the direct benefits of such internships to their companies other than the satisfaction of benefiting students and teachers at this point.

Specifically, company representatives mentioned the following benefits to interns:

- Providing students with real work experience
- Helping students get focused on their education and careers
- Helping students see the relevance of school to work
- Giving interns a jump start on entering the world of work

As for the benefits to companies, representatives mentioned the following:

- Exposure of their companies to excellent employee candidates and the opportunity to evaluate potential employees
- The presence of the interns raised the morale of current employees
- Opportunity to emphasize needed skills in the workplace
- Opportunity for public relations and community services

3. *What are disadvantages, if any, of such programs to interns and to your company?*

Most representatives felt the disadvantages of such programs to their companies were minimal. Companies spent time preparing for student internships, but students were

doing the real work and they were productive. Time spent organizing student internship and students' productivity might have canceled each other out if other benefits were not considered. Representative felt initially it was risky to host students interns in their companies because they did not know what they were getting into. One representative pointed out that if students were poorly selected; employees would not commit to the program in the future. On the other hand, if the company was not committed, organized, and ready for them, students might have a negative view of the corporate world.

Company representatives mentioned the following specific disadvantages of such programs to students:

- Limitations on what students could do because of factors such as union agreements, safety regulations, and labor laws.
- Lack of defined goals and objectives for students interns.
- Employment opportunities not guaranteed for these interns.

4. *Do you feel that your company's investment in this internship program was justified? Why?*

All representatives interviewed felt their company's investment in this internship was well justified for the following reasons:

- It is time to establish partnerships between business and education communities for mutual benefit.
- The internship allows them to help improve the skills of the developing workforce.
- The internship is an investment in our young people and their minds are the biggest future asset of our county. Businesses and industries are just now starting to be affected by the all too often superior training of foreign competition.

5. *Would you recommend this program to other companies? Why?*

All representatives would recommend this programs to other companies. Their reasons included following:

- Such programs are beneficial not only to students but also to employers in the long run.
- The more companies are involved, the more responsibilities will be shared.
- The internship has an impact on some students regarding their education and careers.
- The internship makes great public relations and is a great opportunity for companies to serve their communities.
- Education is everyone's business.

6. *What are the other ways you think your company can help students gain similar experience?*

Some representatives made the following suggestions about ways they could help students:

- Field trips
- Guest speakers
- Mentor/Job shadowing
- Part-time employment during the school year
- Developing projects around the 10 core competencies
- Pairing of one employee with one student

7. *If there is an job opening for employees in your department, would you consider hiring one or more of these interns? If yes, why?*

Most representatives expressed their preference of hiring certain interns if there is an opening in their companies. They felt these students already had a good understanding of manufacturing. The internship allowed them a first-hand opportunity to know these students' commitment, discipline, habits, and personalities along with their technical and academic competencies.

Some representatives were concerned with student interns who did not show strong enthusiasm for manufacturing. The way they dressed in the workplace was inappropriate for professionals. Inappropriate dress included baseball caps, untucked shirts, and worn-out jeans.

8. *Do you feel you have adequate communications and support from the Boeing coordinators for this internship program? Do you feel comfortable talking with them? Do you feel educator interns communicate well with the student interns?*

Despite the frustration they felt about Boeing coordinators' last minute changes that caused misunderstanding and confusion, all representatives indicated that they had adequate communications and support from the Boeing coordinators. Boeing coordinators were described by them as responsible, responsive, approachable, and outstanding.

9. *What were the best parts of the internship? Why?*

Parts of the internship that representatives mentioned as "the best" included the following:

- Companies working together for the benefit of students
- Providing students with real workplace experience in their area of interest
- Bonding of mentors and interns
- Message sent to employees that companies are investing in the future

- The flexibility given to each company for running the internship program
- The satisfaction on the part of students and employers with accomplishments

10. What parts of the internship should be improved for next year?

Representatives made the following suggestions for program improvement:

- Have more time with interns for planning before their employment
- Clearly define goals and objectives for the student internship and specify educator interns' roles in their interaction with student interns
- Streamline guidebooks for students and supervisor and mentor books to reduce redundancies and paperwork
- Establish a consistent grading system and evaluate curriculum annually
- Improve the process of matching students to different companies
- Provide opportunities for student interns to share their experience during the internship
- Make presentations as short as possible
- Provide student interns with a glossary of terminology and acronyms
- Establish in-depth profiles of student interns for future placement into companies
- Improve the selection processes for better students and educators
- Study effective techniques or methods used by some of the sponsoring companies and allowing companies to learn from each other
- Increase the interns' hourly pay

SUMMARY OF FINDINGS

This report draws its findings from surveys of and interviews with student interns and non-Boeing company representatives in the summer of 1995. A total of 169 student interns responded to surveys. Twenty student interns and 19 non-Boeing company representatives were interviewed. This section summarizes the major findings of the 1995 Boeing student internship with reference to the findings from the previous two years.

1. Data from this year and the previous two years clearly indicate that the Boeing internship has motivated students to stay in school and continue their education in their areas of interest. It provides valuable work experiences for students not only in basic employability as well as in specific areas of manufacturing technology. Almost all interns we surveyed in the past three years indicated they would recommend the internship to their friends.

2. The internship is very successful in teaching the manufacturing-related skills designated at each level of the summer internship. Data for 1995 and the previous two years consistently show that students' knowledge of these skills increased significantly by the end of each summer internship. Learning these skills during the summer internship helped students relate skills and knowledge acquired in school to those used in the workplace. However, the student internship has limited impact on changing instruction in those schools from which student interns were selected.

3. In the past three years, student interns consistently rated the learning environment of the Boeing internship as superior to that of the high schools from which they came. For example 91 percent of the interns indicated their Boeing instructors helped them see the purposes for what they were learning, whereasas only 67 percent of the interns indicated so about their high school teachers.

4. Over the past three years, students consistently identified teamwork, hands-on experience, learning various manufacturing-related skills, and being treated as adults as major strengths of the internship. Students have generally become more self-confident after their summer internship.

5. Students were generally satisfied with the recruiting process and felt the orientation was helpful. Most students were able to handle the interview questions. However, students wanted to have more information before the interview.

6. Over the past three years, students expressed that they had benefited enormously from hands-on experiences through the internship. But they still felt the opportunities for hands-on experiences during the internship could be strengthened. They suggested that in-class lectures be shortened and be sequenced to reduce redundancies.

7. Interviews with student interns and non-Boeing company representatives show that other manufacturing companies are also willing and able to provide internship

opportunities for students. Third-year Boeing interns had a smooth transition from Boeing sites to non-Boeing sites this summer. Students felt that the previous two years' experience at Boeing was helpful for their third-year internship at these new sites. Non-Boeing company representatives were enthusiastic about hosting student interns in their companies and felt the investment in such programs was justified for the benefit of students as well as for their companies in the long run. They would like to work closely with Boeing to further define the goals and objectives of such internships so that they will be able to do a better job next year.

RECOMMENDATIONS

1. **Continue the internship**

Over the past three years the evaluation results have facilitated continuous quality improvement for the internship program. The results of the evaluation also clearly indicate that the internship has had a positive impact on many students in their educational aspirations and career plans. The Boeing staff is to be commended for introducing the internship program into other manufacturing companies; the placement of advanced Boeing student interns at non-Boeing sites has turned out to be successful. In conclusion, the Boeing internship is a valuable program and deserves further funding to continue at Boeing and to expand to other manufacturing companies.

2. **Connect with school-based programs**

While the student internship has operated effectively and benefited participating students, the internship experience generally stands isolated from the students' high school curriculum. Thus, from a systemic perspective, its full impact on the education of high school students is limited. As is true for most school-to-work efforts across the country, there is a crucial need for an effective link between school curriculum and work-based experiences. We recommend:

- Student selection criteria should be structured to admit to the program only those students who: 1) are interested in manufacturing technician work as shown in their individual career and education plans, 2) have taken one or two CORD applied academics courses or other academic courses that include application to the workplace, and 3) have taken at least 2 sequenced courses in manufacturing technology or a related field.

- The consecutive three-year internship should equip these interns with skills adequate for an entry manufacturing technician position. Efforts need to be made to help these students find a job in the field after they have completed a manufacturing-related degree.

- To connect the interns' school coursework with their summer internship experiences, participating schools might also be required to have a team of at least four academic and vocational teachers plus one school counselor and one school

administrator to observe a minumum of one day of the first year student internship and establish some ways they could address some of the internship competencies in their regualar school year courses.

3. **Provide an exploratory workplace experience**

For those 10th grade students who are not sure if they want to go into the manufacturing field, an exploratory workplace experience might be designed jointly by Boeing and participating high schools, such as a one-week summer camp, visitation to several manufacturing firms, plus other school-based experiences. Such a program could also provide these students with some overall understanding of the workplace and allow them to complete a project demonstrating the relevance of school work to the real world. These students could then be candidates to participate in the consecutive three-year internship if they demonstrated serious interest in a career in manufacturing. The Boeing Company could use experiences like these to screen internship candidates.

4. **Improve the internship curriculum**

Our data show that many of the student interns were interested in the relationship between manufacturing and engineering. Next year's curriculum might include this topic.The internship should continue to focus on hands-on activities that students do not have the opportunity to perform in school settings. The necessary classroom instruction provided during the internship should be as short as possible and be directly related to the hands-on projects that follow.

6. **Help student interns find relevant jobs**

Last year most Boeing interns had temporary jobs unrelated to manufacturing. We recommend coordinating with regional manufacturers that hire part-time workers for possible employment of students during the school year or as summer replacements. For example, in partnership with Spokane Community College, Kaiser Aluminum Co in Spokane hired students to be summer replacement workers for its employees on vacation. The program has been very successful. Many of those student interns have ended up being employed by that company.

7. **Continue to use evaluation as a tool for program improvement**

Over the past three years the program evaluation has proved to be useful for continuous quality improvement. For next year's evaluation, we recommend: 1) a follow-up study of graduates from this summer, 2) a study of those students who dropped out of the internship this summer, 3) continued pre- and post-assessment of student interns at all three levels, and 4) a review of internal evaluation such as student performance test results.